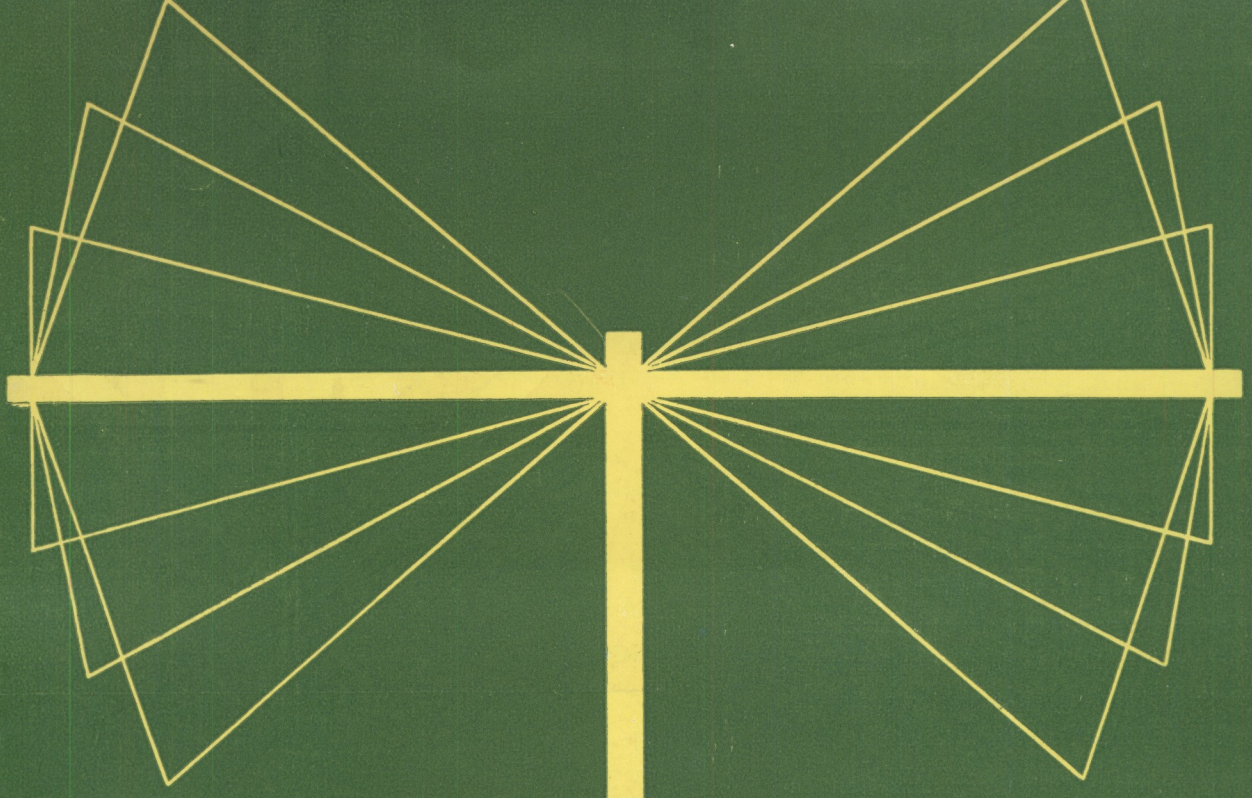
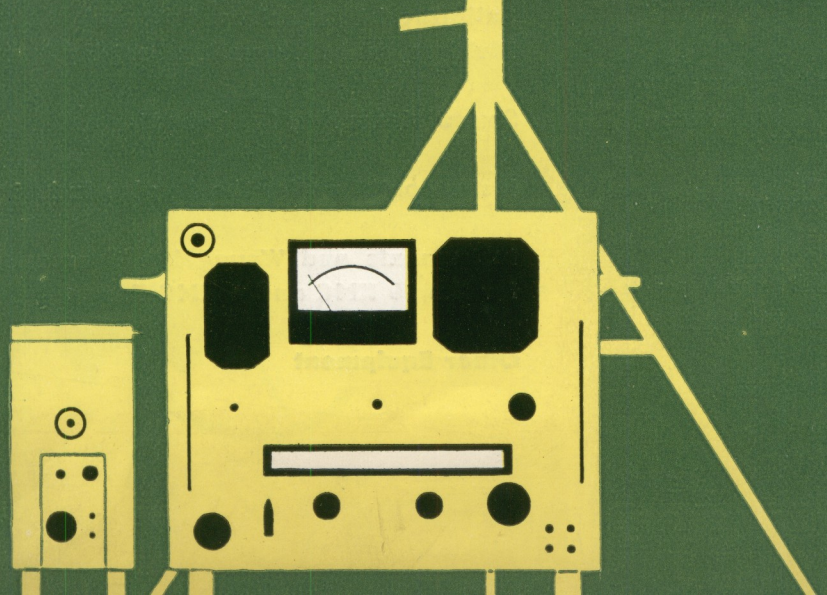


ELECTRONIC MEASURING EQUIPMENT

VEB WERK FUER FERNMELDEWESEN

WF



PREFACE

The era of electronics we are living in has pioneered the way for electronic equipment to be used in key positions throughout the industries. Today the wide range of industrial and increasingly automatic production, the commercial field of communication as well as the entertainment industry with its various outgrowths of broadcasting, television and sound-talking film would be unthinkable without its use.

It is up to the great many design engineers, test engineers, and technicians to evolve novel electronic designs and to complete them. Numerous technically trained personnel is about to care for the maintenance of the installations and instruments.

The equipment used by these specialists must be of modern design and great reliability to render their work successful and effective.

The Werk für Fernmeldewesen is set the task to include into its working program a major part of the equipment required for the electronic fields outlined above.

For this reason we have been designing and manufacturing nearly complete lines of radio-frequency and U.H.F. test and measuring equipment, such as signal generators, level meters and test receivers, field strength meters, calibrated attenuators and measuring filters, measuring bridges, waveguide components, complete test assemblies for the TV service industry as well as instruments for TV studios and closed-circuit remote control equipment.

The booklet gives a brief insight into our activities. Look for yourself to learn the versatility and efficiency of the equipment in production and of new instruments under development significally extending the assortment within the next few years.

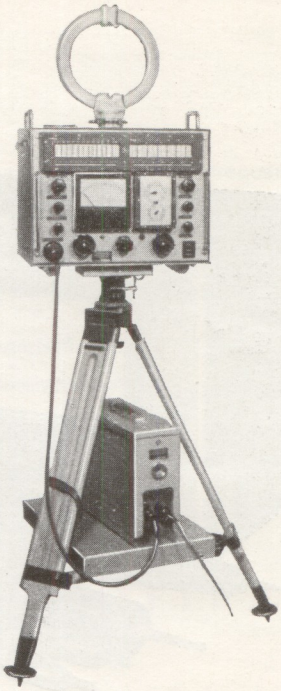
Kindly communicate with us for more detailed information. Single data sheets covering all instruments will be sent upon request.

Write for particular information on before-mentioned TV equipment not contained in this catalog.

Our information service will be of further assistance in providing regularly up-to-date descriptive literature of latest instruments.

SUMMARY OF CONTENTS

Field Strength Meter FSM 1



This device is used to determine the field strength of amplitude-modulated and non-modulated transmitters at frequencies between 0.1 and 30 mc and is capable of measuring antenna diagrams, propagation and sweep radiation reflected by oscillators and generators.

Moreover, the receiver is intended for use with an adapter (accessory if required) as a sensitive selective vtvm and indicating instrument. Voltage range 1 μvolt — 450 mvolts, accuracy within $\pm$ 1 db.

The field strength meter consists of the receiver, the frame antennas, and the power unit the latter being replaced by a converter, if necessary.

Field strength range 2 μvolts/m — 100 mvolts/m (indication both linear and logarithmic), accuracy $\pm$ 2 of db reading, full frequency coverage approximately 2 kc.

INSTRUMENTS FOR VOLTAGE AND LEVEL MEASUREMENT, FIELD STRENGTH METERS, AND RECEIVERS

Field Strength Meter FSM 2-1

The function of this unit is to measure the field strength of non-modulated, pulse modulated, a. m. and f. m. modulated transmitters at frequencies from 20 to 100 mc, moreover, to measure antenna diagrams and propagation as well as to record the time sequence of the transmitter field strength in the specified frequency range.

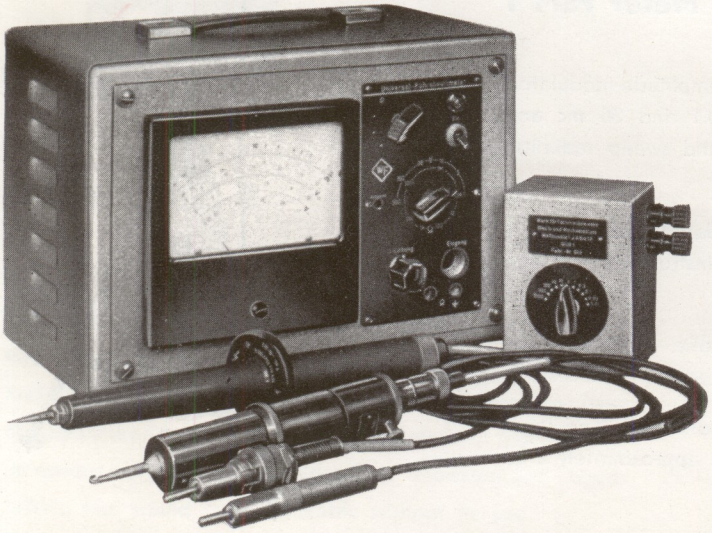
The field strength meter is also used as a calibrated and highly sensitive test receiver.

The field strength meter considered comprises the receiver, the wide-band dipole antenna having four matched sections, and the power unit. The latter can be replaced by a converter, if necessary.

Receiver frequency range divided into 8 ranges. Field strength range 0.5 μvolt/m — 200 mvolts/m, accuracy within $<$ 2 db.

First i. f. = 10.7 mc (wide-band), second i. f. 1.0 mc (narrow-band), i. f. bandwidth for first i. f. approx. 150 kc, for second i. f. approx. 10 kc, voltage range (linear) 0.5 μvolt — 30 mvolts, voltage range (logarithmic) 0.7 μvolt — 1 volt, accuracy within $\pm$ 1 db.

Receiver input resistance 70 ohms.



Universal Tube Volt Meter URV 1

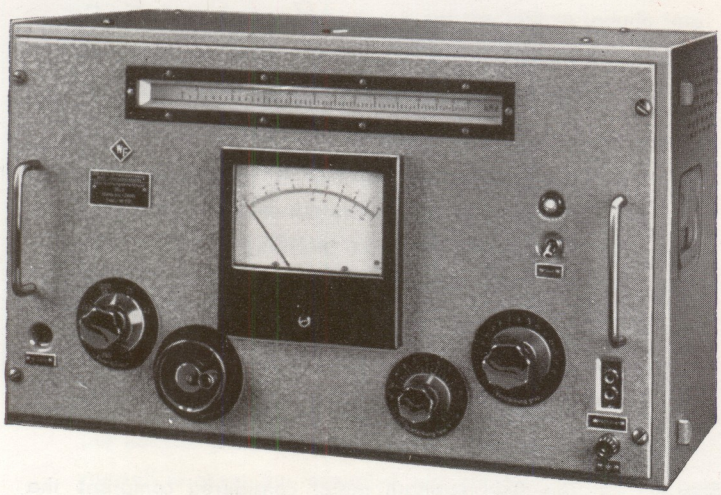
This universal vtvm is capable of measuring both d. c. and a. c. voltages as well as ohmic resistances in the presence of a high input resistance.

Six d. c. voltage ranges 0.1 to 300 volts (by use of a high voltage probe extended up to 25 kvolts), input resistance 10 Mohms (by use of a high voltage probe extended up to 1,000 Mohms).

Four a. c. voltage ranges 0.1 to 15 volts (30 c to 230 mc). Seven a. c. voltage ranges 0.1 to 1,000 volts (30 c to 30 kc). Input resistance 200 kohms — 10 kohms.

Eleven current ranges (provided by the additional measuring set MUR 1) 1 μamp to 1 amp (0 c, 30 c to 20 kc).

Seven resistance ranges 1 ohm — 100 Mohms.



Superhet Receiver ÜEL 2

Owing to its particular sensitivity the receiver is intended primarily for use as an indicating instrument of a crosstalk test assembly. Using zero and comparison methods the receiver can be also involved in any measurement on the 10 kc to 1.2 mc range where it is ideal for operation as a selective indicating instrument.

Eight frequency ranges covering 10 kc to 1.2 mc, tuning control accuracy $\pm$ 1 %, sensitivity — 13.5 nepers (approx. 1 μvolt), sensitivity coarse control 15 stages each amounting to approx. 1 neper, continuous, sensitivity micrometer control approx. 1.2 neper, bandwidth approx. 200 cycles, input asymmetric, input resistance 10 kohms, input capacitance $\leq$ 25 pf, maximum usable heterodyne d. c. input voltage 250 volts, intermediate frequency 1 kc.

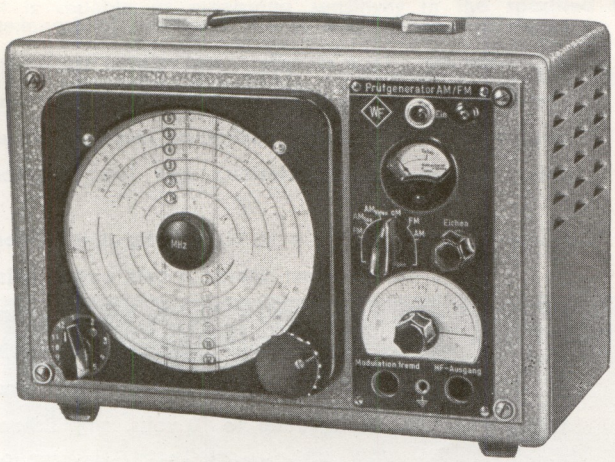
LATEST INSTRUMENTS

Field Strength Meter FSM 3

This field strength meter lends itself to the measurement of electromagnetic fields in c.w., a.m. and f.m. operation in the frequency range from 87 to 300 mc. Beyond that, it is intended to measure the wave propagation of transmitters and to record the time sequence of field strength. As a calibrated and highly sensitive vtvm it makes possible r.f. voltage measurement. The field strength meter is made up of the receiver, a fixed-tuned wide-band antenna and the power unit that can be replaced by a converter, if necessary.

Field strength range 2 μvolts/m – 100 mvolts/m, relative accuracy < 2 db. Intermediate frequency 30 mc, i.f. bandwith approx. 300 kc, voltage range (linear) approx. 1 μvolt–31.6 mvolts, voltage range (logarithmic) approx. 1 μvolt–1 volt, accuracy $\pm$1 db. Receiver input resistance 70 ohms.

TESTING POWER SOURCES AND AMPLIFIERS



A.M./F.M. Signal Generator PG 1

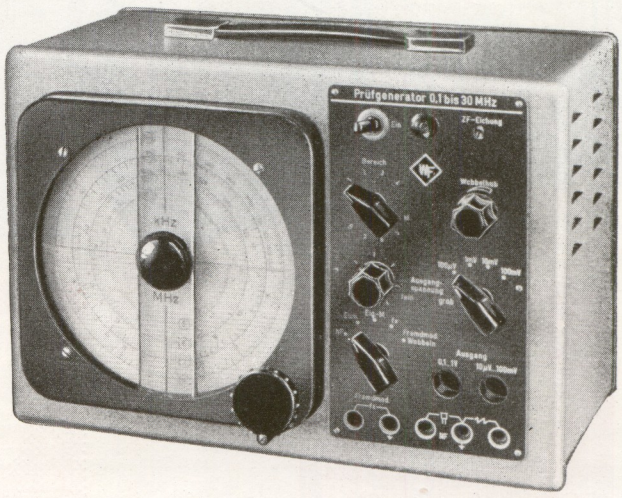
The generation of a defined and continuously adjustable voltage subjected to amplitude and frequency modulation warrants the use of this generator in tests for the amplification and sensitivity of a.m. and f.m. receivers as well as for the point-by-point display of response characteristics and the balancing of tuned circuits.

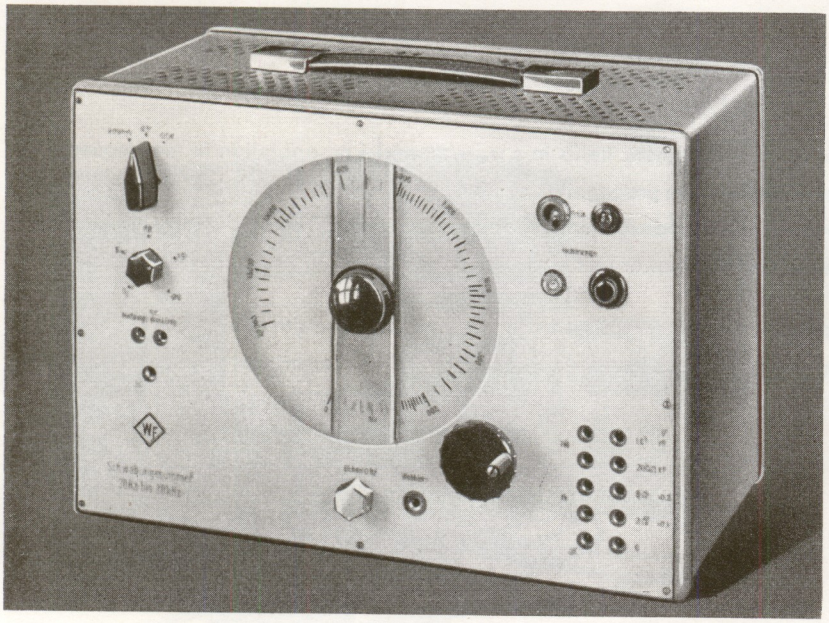
Twelve tunable frequency ranges 5 — 235 mc, frequency accuracy within $\pm$ 1 %, output voltage 10 μvolts — 50 mvolts (asymmetric, continuously variable), distortion factor $\leq$ 20 %. Internal a.m.: 1 kc $\pm$ 15 %, m = (35 $\pm$ 10) %.
External a.m.: f = 50 c — 20 kc at $f_{carrier}$ = 5 — 235 mc
f = 50 c – 5.5 mc at $f_{carrier}$ = 20 — 235 mc
Internal f.m.: f_{mod} = 1 kc $\pm$ 15 %, $\triangle f$ = 2 kc
External f.m.: f_{mod} = 50 c — 20 kc, $\triangle f$ = 2 kc

Signal Generator PG 2

The signal generator is designed for use over the 0.1 to 30 mc region thus embracing all a.m. broadcast ranges. A salient feature of the generator — its use as a sweep generator — permits in conjunction with a cathoderay oscilloscope a sweep of all frequencies covering 435 to 520 kc. The deviation that can be applied does not exceed $\pm$ 15 kc.

Frequency range 100 kc — 30 mc tunable in 8 ranges, accuracy of adjustment $\leq$ 1 %, output voltage (low resistance) approx. 10 μvolts — 100 mvolts at 75 ohms, output voltage (high resistance) approx. 100 mvolts — 1 volt at R_i about 300 ohms, distortion factor $\leq$ 10 %.

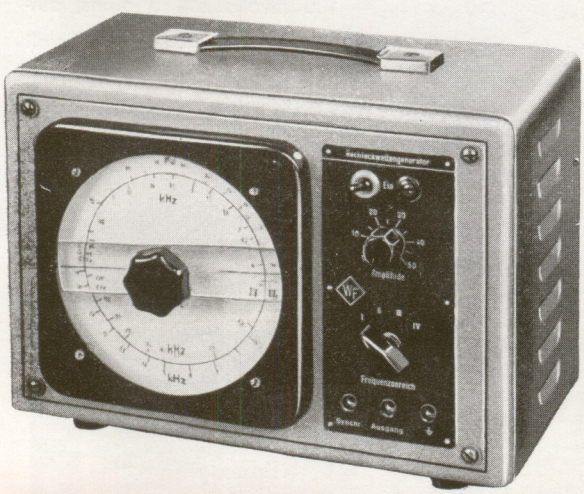




Beat Frequency Oscillator SSU 2

The b. f. o. induces an a. f. voltage of a defined and continuously variable frequency within specified limits. The unit serves to make a check of a. f. amplifiers, loudspeakers, a. f. transmitters, tape recorders, and related equipment. The amplifying section of this unit can be advantageously employed as a measuring amplifier, on account of its unbalanced response characteristics and low distortion.

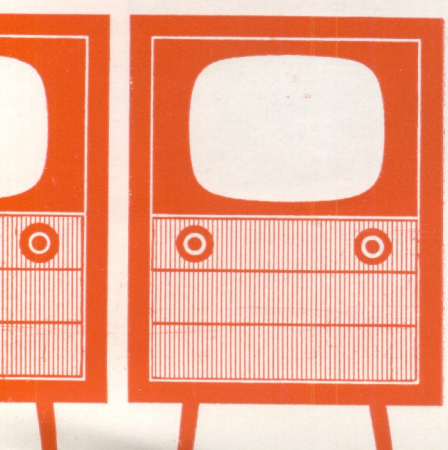
Frequency coverage 30 c — 20 kc, accuracy of adjustment $\leq$ 2 % $\pm$ 5 c, power output approx. 1 watt, output resistances 2, 8, 200 ohms and L-C output, output voltage accuracy < 10 % of input voltage, response characteristics < 10 %, distortion factor < 0.8 %. Heterodyne frequency measurement for voltages up to 10 volts, amplification highly resistant input, max. amplification factor 400 (at 200 ohms), 2,000 (at L-C output), sweeping of the oscillator frequencies by variable capacitors to be connected.

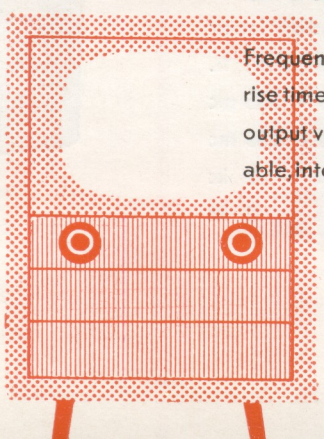


Square-Wave Testing Generator RWG 2

Used in conjunction with a cathode-ray oscilloscope the square-wave generator is designed to test broadband amplifiers, e. g. the video section in tv receivers. The generator obviates the necessity for a point-by-point display of the amplification curve and may be utilized to obtain a bar pattern on the picture screen of the tv receiver.

Frequency range 50 c — 500 kc tunable over 4 ranges, rise time $\leq$ 80 nsec, sloping top $\leq$ 2 %, duty cycle 1:1 (+ 10 %), output voltage from 0.1 to 3 volts$_{\text{pk to pk}}$, continuously variable, internal resistance 150 ohms asymmetric, 4 mfd in series.

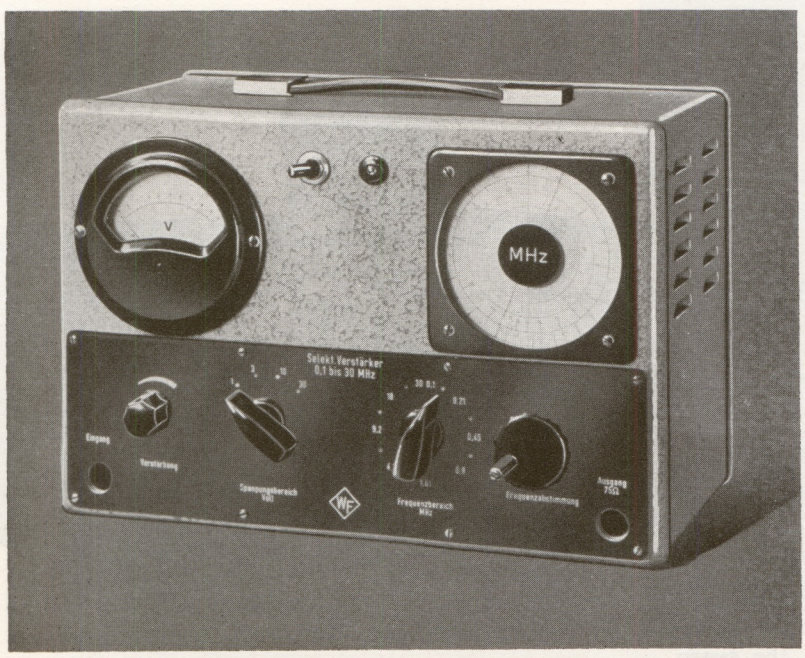




Noise Generator RSG 2

The noise generator provides a standard noise output between 0 and 75 kT_o at frequencies ranging from about 10 to 300 mc. To meet the requirements of coaxial transmission lines the r.f. section of the generator is matched with Z = 70 ohms. It is capable of measuring sensitivity in the specified frequency range without major expenditure of equipment.

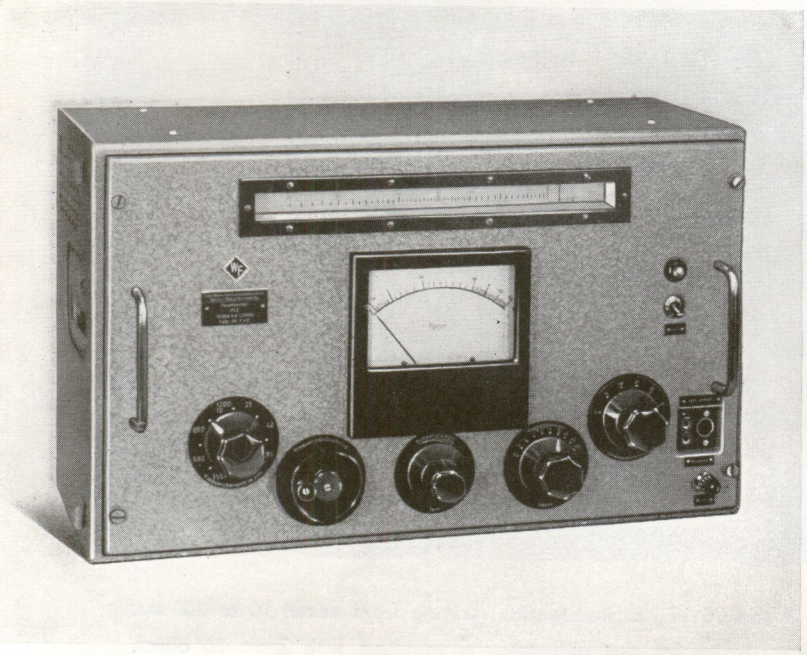
Measuring range I 0 — 15 kT_o, accuracy within $\pm$ 10 % $\pm$ 0.25 kT_o. Measuring range II 0 — 75 kT_o, accuracy within $\pm$ 10 % $\pm$ 1.0 kT_o.



Power Amplifier LV 1

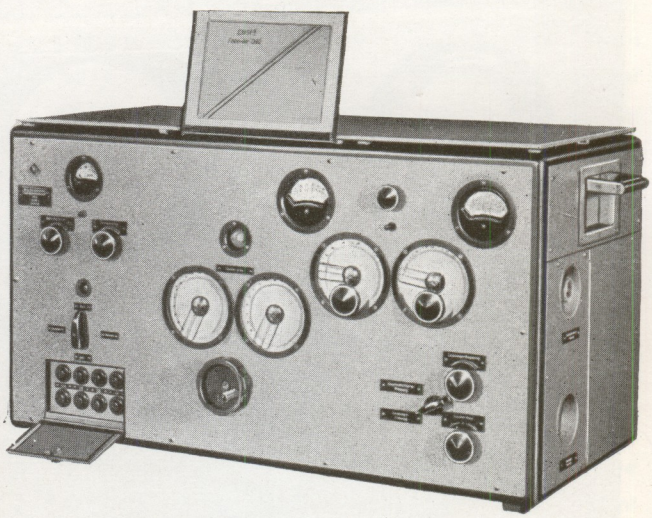
The power amplifier is intended primarily to complete the signal generator PG 2 thus extending the latter to a power oscillator. Beyond that, the amplifier can also be suitable for use as a power amplifier for all generators operating on the 0.1 to 30 mc band.

Eight frequency ranges 100 kc — 30 mc, amplification factor $\geq$ 40 db, input resistance 100 kohms — 500 ohms dependent of frequency, max. input voltage 150 mvolts, output voltage 6 volts at 75 ohms and 17 — 30 mc, 10 volts at 75 ohms and 100 kc — 17 mc, distortion factor $\leq$ 3 %.



Level Oscillator PS'3

The level oscillator is a power generator used for crosstalk and overall loss measurement within the 10 kc to 1.2 mc frequency range. In conjunction with the superhet receiver ÜEL 2 it is adaptable to attenuation measurements up to 17 nepers due to its power output of 4 watts. The output voltage is adjustable over wide ranges from — 8 to 3.1 nepers at 75 ohms. The input resistance totaling $\leq$ 20 ohms may be switched over symmetrically and asymmetrically to 150 and 600 ohms. Maximum output voltage applied to the oscillator results in a distortion factor of $\leq$ 6 % decreasing to $\leq$ 3 % in the case of an output voltage of $\leq$ 2 nepers. All these features mentioned destine the level oscillator to a variety of measurements made on carrier frequency equipment and enable its use as a testing generator of measuring bridges.



Sensitivity Test Oscillators EMS 1, EMS 2, EMS 3

The sensitivity test oscillators are r.f. oscillators used for c.w. and sweeping operation with a full frequency coverage of λ = 9 — 100 cm (3,333 — 300 mc). The output voltage that is applied ranges from 2 μvolts to 10 mvolts, accuracy is within $\pm$ 15 % $\pm$ 1 μvolt of reading. The oscillators are designed to provide variable and defined r.f. voltages when, for instance, involved in sensitivity measurements of instruments. By way of switching over they can find use as power test oscillators capable of supplying 1 watt r.f. power at 70 ohms in the respective wave range. The sweep frequency totals about 400 cycles.

Test oscillator EMS 1 covering λ = 9 — 15 cm (3,333 — 2,000 mc), accuracy approx. $\pm$ 1.5 %.

Test oscillator EMS 2 covering λ = 15 — 30 cm (2,000 — 1,000 mc), accuracy approx $\pm$ 1.0 %.

Test oscillator EMS 3 covering λ = 30 — 100 cm (1,000 — 300 mc), accuracy approx. $\pm$ 0.5 %.

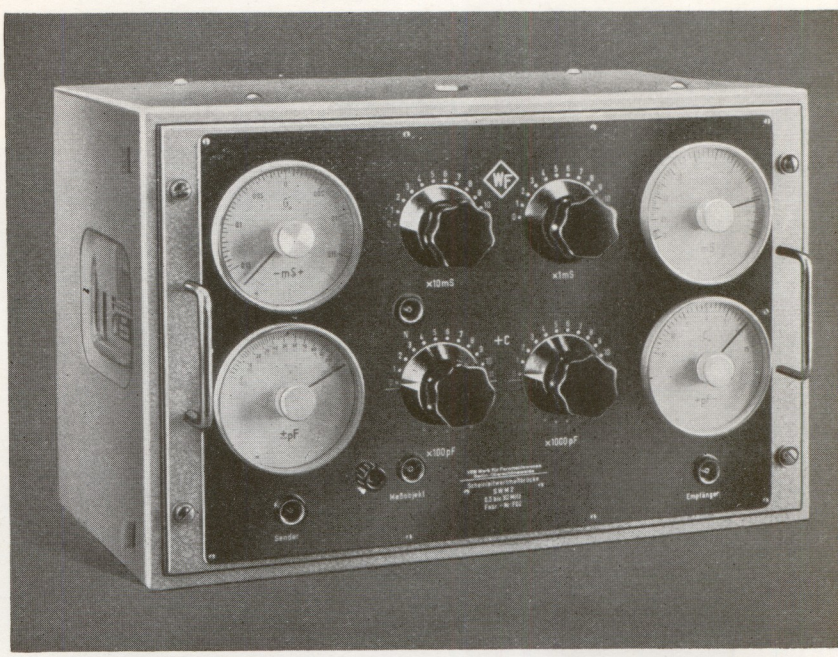
Square-Wave Testing Generator RWG 4

Used in conjunction with a cathode-ray oscilloscope the square-wave generator is intended to test broad-band amplifiers, e.g. the video section in tv receivers.

The square voltage deformed by the test specimen serves for the immediate detection of its behavior, such as sloping top, overshoot, cutoff frequencies, and steepness of the response curve thus eliminating need for a point-by-point display of the amplification curve.

Moreover, this device lends itself readily to the generation of a bar pattern on the picture screen of a tv receiver which is used to check the linearity of the two deflection systems, streaking, reflections, and resolution. Frequency coverage 50 c — 500 kc tunable over 8 ranges, rise time $\leq$ 40 nsec, sloping top $\leq$ 2 %, duty cycle adjustable to absolute symmetry, no-load voltage of the output with respect to earth $\leq$ 0.5 to $\geq$ 3.5 $volts_{pk\ to\ pk}$ at R_i = 150 ohms or $\geq$ 0.25 — 1.75 $volts_{pk\ to\ pk}$ at R_i = 75 ohms, continuously variable, input resistance 150 ohms or 75 ohms.

IMPEDANCE METERS



Admittance Bridge SWM 2

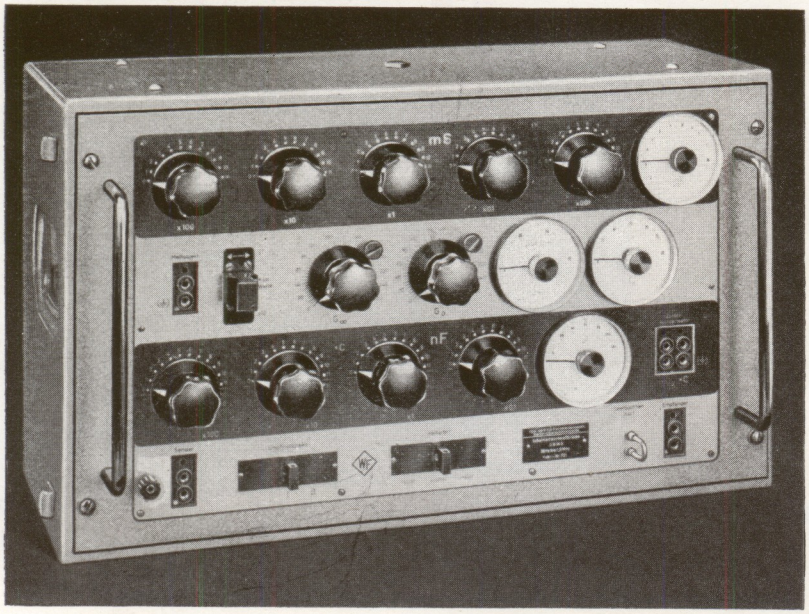
The admittance bridge is designed to measure the dissipative and reactive admittances or impedances of any asymmetric objects under test.

Frequency coverage 0.5 — 30 mc, measuring range of the dissipative component 0.1 — 100 mmhos, measuring range of the reactive component $\pm$ 0 — 33 mmhos, adjustment range of the reactive component $\pm$ 0 — 12 nfd, accuracy $\pm$ 2 — 5 % $\pm$ 2 mmfd.

Measurement of objects having approximately known Z values: frequency coverage 0.5 — 10 mc.

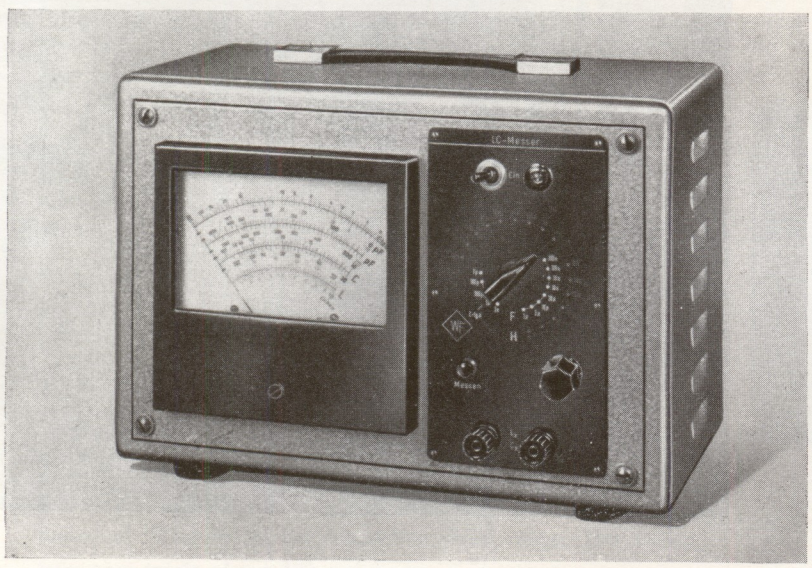
Measuring range of the dissipative component related to the standard Z value (within 10 — 20 mmhos) $\pm$ 0.15 mmhos, accuracy $\pm$ 0.1 % including error of comparison standard.

Measuring range of the reactive component $\pm$ 10 mmfd, accuracy $\pm$ 1 mmfd, maximum input voltage approx. 15 volts.



Admittance Bridge SWM 3

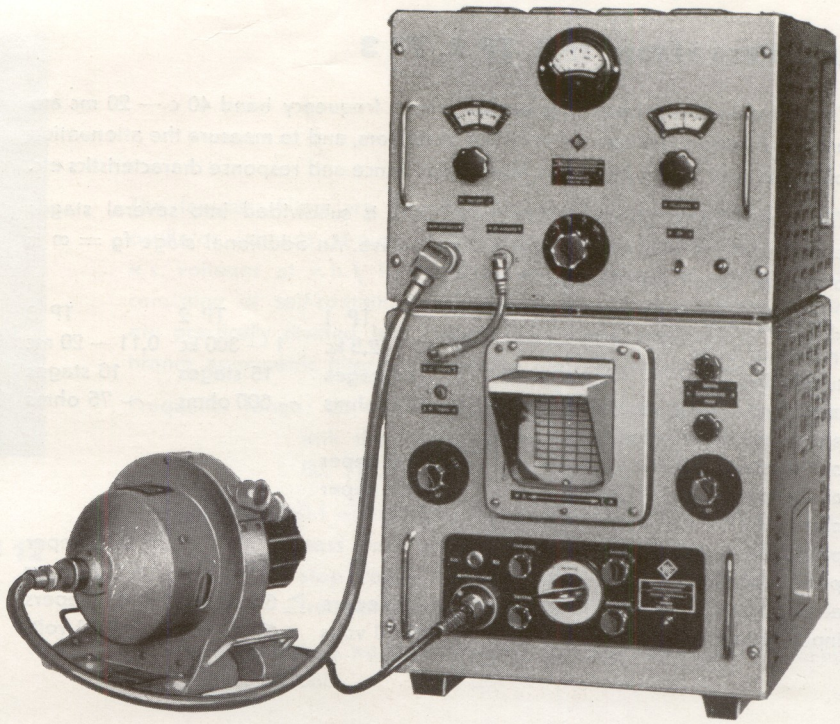
The admittance bridge is adaptable to the measurement of dissipative or reactive admittances or impedances of unipolarly grounded, balanced and earth-free test specimens. It is designed for operation in the 30 c to 1,500 kc frequency range. Measuring range of the dissipative component 1 μmhos — 1,000 mmhos, measuring range of the reactive component $\pm$ 1 μmhos — 100 mmhos, adjustment range of the reactive component $\pm$ 0 — 1.2 mfd, accuracy within $\pm$ 1 — 5 %, maximum input voltage approx. 15 volts.



Inductance/Capacitance Meter LCM 1

This device measures values in terms of inductance and capacitance of coils and capacitors. Used in conjunction with the ancillary tan δ unit TLC 1 it detects also the loss angle size of capacitors. Twelve capacitance ranges 1 mmfd — 300 mfd, accuracy $\pm$ 4 %. Sixteen inductance ranges 10 nH — 10 H, accuracy $\pm$ 4 %. Measurement of tan δ in the tan δ range 0.001 — 1.

LATEST INSTRUMENTS



Automatic Standing Wave Indicators RML 1, RML 1-1, RML 2

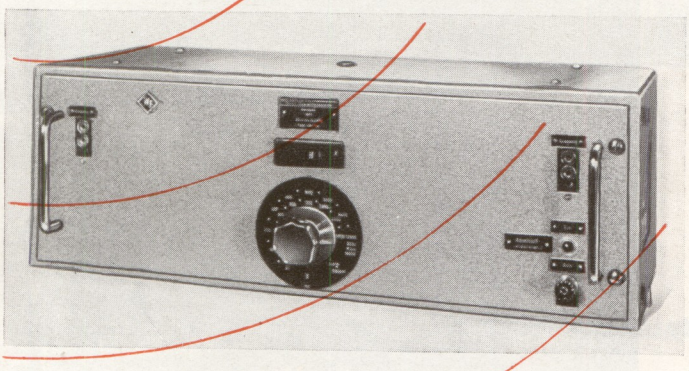
The standing wave indicators allow for the immediate and convenient measurement of adaptation and resistance in accordance with amount and phase. Each test assembly consists of the indicating section, receiving section and visual display.

U.H.F. standing wave indicator RML 1:
frequency coverage 2,000*) — 3,300 mc,
nominal characteristic impedance Z = 70 ohms.

U.H.F. standing wave indicator RML 1-1:
frequency coverage 2,000**) — 3,300 mc,
nominal characteristic impedance Z = 60 ohms.

V.H.F. standing wave indicator RML 2:
frequency coverage 60 — 300 mc,
nominal characteristic impedance Z = 70 ohms.

*) Indicating section designed for 600 — 3,300 mc
**) Indicating section designed for 375 — 3,300 mc
Adequate receiving sections to be under construction



Band-Pass Filter BP 1

MEASURING FILTERS

The band-pass filter is required in frequency measurements to filter out certain frequencies and is involved in frequency analyses of noises and sounds in the 35 c to 19.2 kc frequency range.

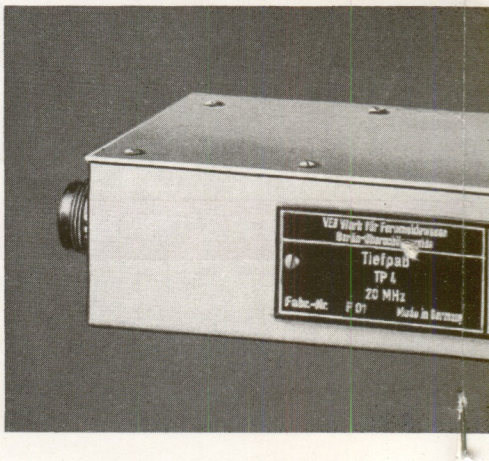
The filter is made up of two ranges that are shifted against each other for half an octave.

Pass-band I ranges over 8 octaves at 35 — 9,600 c and has a 0 — ∞ position.

Pass-band II ranges over 9 octaves at 50 c — 19.2 kc and has a 0 — ∞ position.

Input resistance amounting to approx. 600 ohms, output terminated by 600 ohms, attenuation in the pass-band center $\leq$ 0.3 neper, attenuation outside the pass-band center $\geq$ 2.0 nepers. Positions from 0 to ∞ exhibiting an attenuation of $\leq$ 0.6 neper. Input voltage $\leq$ 0.3 volt.

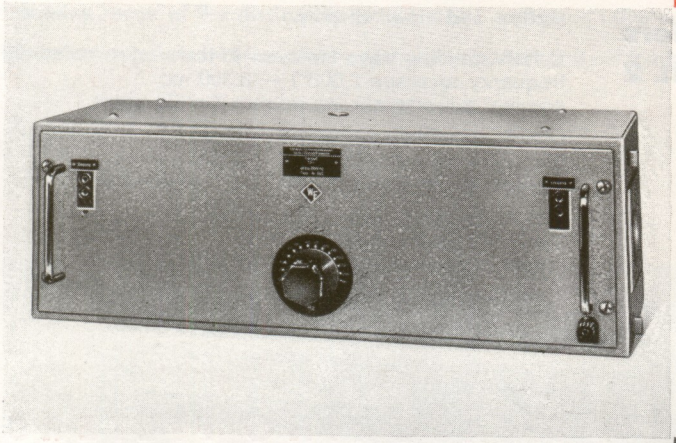
Low-Pass Filters TP 1, TP 2, TP 3



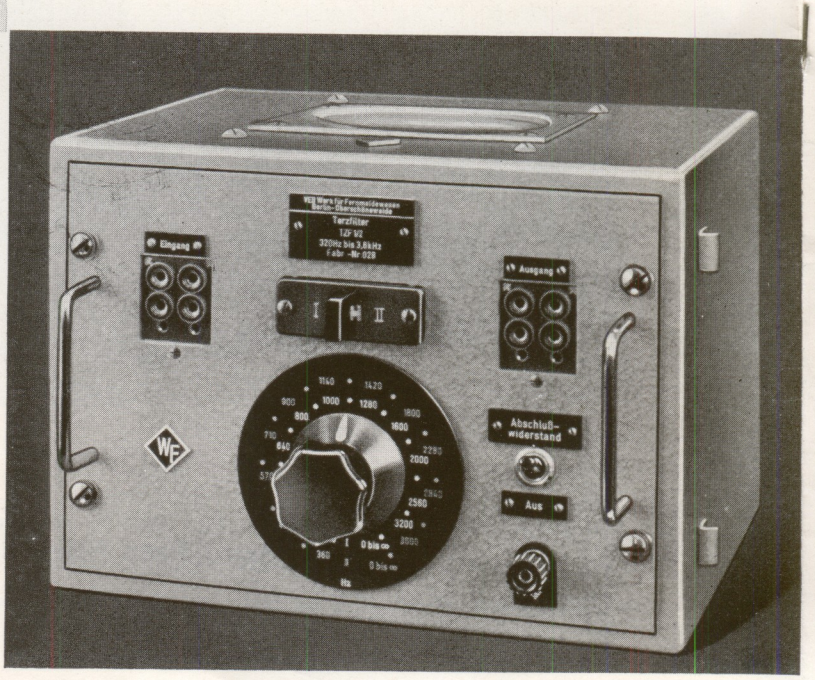
The low-pass filters operating on the entire frequency band 40 c — 20 mc are used to suppress the harmonics of test oscillators, and to measure the attenuation of ladder-type filters, high-pass filters, impedance and response characteristics etc.

The frequency range of all low-pass filters is subdivided into several stages each having an interval of about half an octave. An additional stage fg = ∞ is provided. Circuit asymmetric.

Low-pass filter:	TP 1	TP 2	TP 3
frequency band	40 — 2,5 kc	1 — 300 kc	0,11 — 20 mc
subdivided in	13 stages	15 stages	16 stages
input and output resistance	~ 600 ohms	~ 600 ohms	~ 75 ohms
pass-band attenuation			
of the stage 2,500 c	≦ 0.9 neper		
of the stages 40 — 1,750 c	≦ 0.7 neper		
pass-band		≦ 0.5 neper	
pass-band (up to 950 kc)			≦ 0.15 neper
pass-band (1.3 — 20 mc)			≦ 0.2 neper
attenuation of the first harmonic	≧ 3.0 nepers	≧ 6.0 nepers	≧ 4.0 nepers
input voltage	≦ 10 volts	≦ 10 volts	≦ 10 volts



1/3 Octave Filters TZF 1, TZF 2, TZF 3

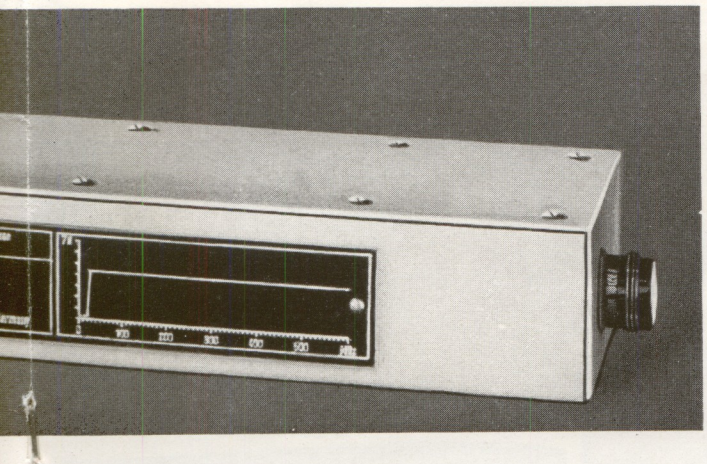


One third octave filters are required in frequency measurements to filter out certain frequencies and are involved in frequency analyses of noises and sounds within the full frequency coverage 32 c to 36 kc.

The octave filter TZF 1 is designed for operation over the 32 c — 360 c, TZF 2 over the 320 c — 3.6 kc, and TZF 3 over the 3.2 — 36 kc band.

The octave filters each provided with two groups of measuring ranges that are shifted against each other for one sixth of an octave are designed as divalent filters in a T-circuit.

Input resistance approx. 600 ohms. Asymmetric output termination 600 ohms. Attenuation at the center of each pass-band approx. 0.7 neper, attenuation at ± 1 octave outside the band center approx. 5 nepers, attenuation at ± 3 octaves outside the band center approx. 7 nepers, input level ± 0 neper.



Low-Pass Filters TP 4 — TP 12

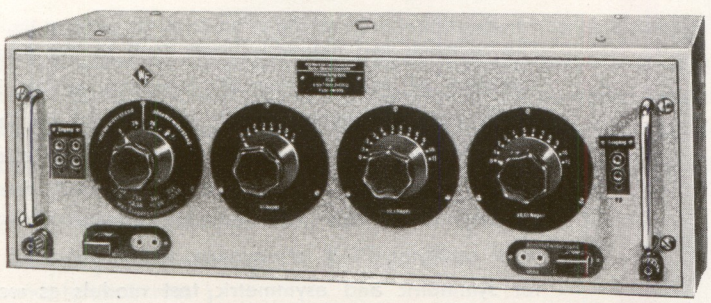
The low-pass filters are intended to suppress the harmonics of test oscillator voltages as well as to filter out the fundamental wave of a.c. voltages at v.h.f. These filters are combined in a filter group consisting of self-contained low-pass filters whose cutoff frequencies are practically divided into stages. Every stage incorporates a three-branch asymmetric filter which can be also separately used.

Frequency range: 20 — 300 mc, subdivided into 9 separate filters with the band-pass frequencies 0 — 20, 28, 40, 56, 80, 110, 160, 220, and 300 mc.

Overall loss: 0.1 — 0.2 neper, in the band-pass width at the band-pass limit increasing up to 0.4 neper, in the band-stop region at the 1.4 to 3-fold band-pass cutoff frequency $\geq$ 4.6 nepers.

Maximum band-pass wattage 2 watts, matched resistances 75 ohms. Connections VB 058.

CALIBRATED ATTENUATORS, POTENTIAL DIVIDERS, AND ATTENUATION TEST EQUIPMENT

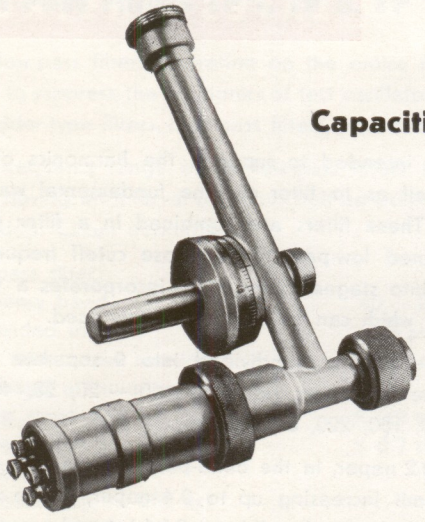


Calibrated Attenuators

The attenuators are decade fourpole networks recommended for multipurpose measurement and operating within the frequency ranges between 0 and 1 mc or 0 and 20 mc respectively. Thereby, the attenuators are primarily used as a reference involved in the determination of the attenuation of fourpole networks. The attenuators ELG 3, ELG 4, ELG 5, and ELG 7 being unbalanced types lend themselves readily to the measurement on coaxial cables and their corresponding transmission units whilst the attenuators ELG 1, ELG 2, and ELG 8 are suitable for measurement of balanced systems. The 0 — 15,21 neper range is subdivided into 1 stage (7 nepers), 7 stages (1 neper), 11 stages (0.1 neper), and 11 stages (0.01 neper).

In the manufacturing program of attenuators following designs are included:

ELG 1	Z = 135 ohms	balanced H circuit	0 — 1 mc
ELG 2	Z = 600 ohms	balanced H circuit	0 — 1 mc
ELG 3	Z = 135 ohms	unbalanced π circuit	0 — 1 mc
ELG 4	Z = 600 ohms	unbalanced π circuit	0 — 1 mc
ELG 5	Z = 75 ohms	unbalanced π circuit	0 — 20 mc
ELG 7	Z = 150 ohms	unbalanced π circuit	0 — 1 mc
ELG 8	Z = 150 ohms	balanced circuit	0 — 1 mc

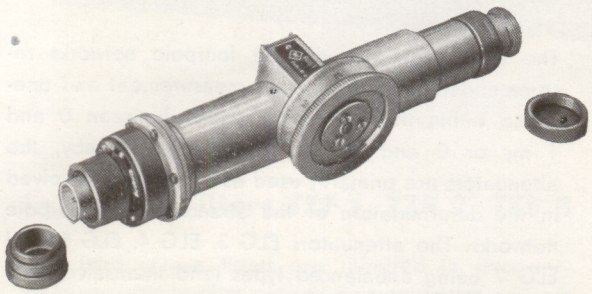


Capacitive Potential Divider KSPT 1

It is the use of the capacitive potential divider to provide defined r.f. voltages on the wave range λ = 8 — 100 cm (3,750 — 300 mc frequency range) and, in addition, to perform adjusting and regulating functions.

Linked with a r.f. generator the potential divider concerned is capable of providing any adjustable r.f. voltage (within its operating range) thus extending the r.f. generator to a sensitivity test oscillator.

Input and output impedance approx. 70 ohms, output voltage approx. 10 mvolts — 2 μvolts (derived from 1 watt power supplied), type of connection r.f. connector 5/16 mm in diam.



Variable Attenuator RDG 1

The variable attenuator allows for the measurement of attenuation differences and makes possible absolute measurement of attenuations as well. It is particularly suitable for dividing voltage provided by test oscillators and for calibrating potential dividers and indicating instruments.

Frequency range 30 — 300 mc, variable attenuation difference 0 — 70 db, Z = 75 and 60 ohms (due to interchangeability of the connectors).

Crosstalk Test Assembly

The crosstalk test assembly lends itself to the measurement of residual parasitic coupling arising in carrier frequency equipment. It is also used for the measurement of the overall loss and voltage attenuation within any symmetric and asymmetric four-pole networks. The test assembly consists of the level oscillator PS 3, attenuation test panel DMF 1 for symmetric and asymmetric test models as well as the superhet receiver ÜEL 2.

Attenuation Test Panel DMF 1

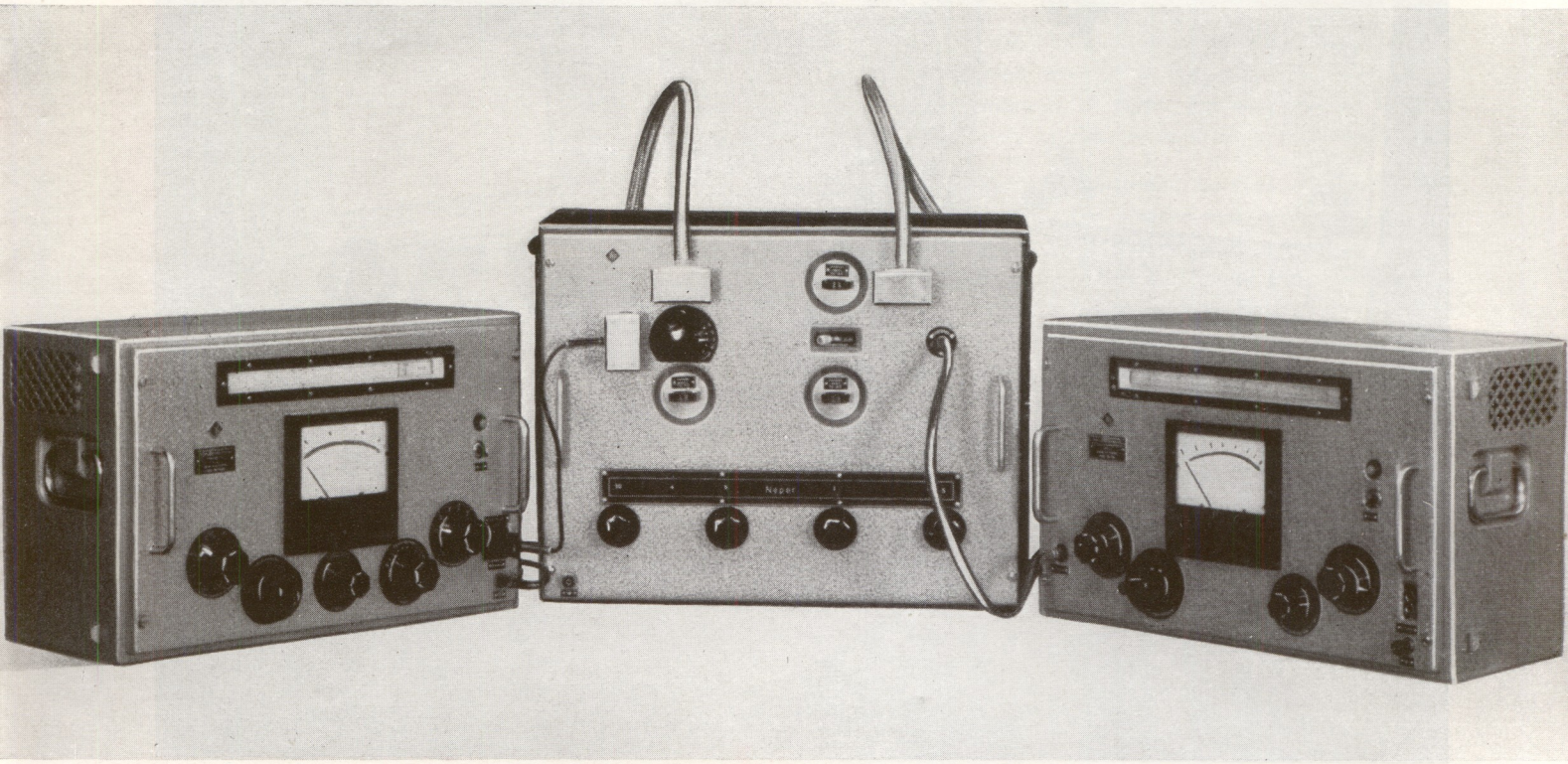
Précis see next page.

Level Oscillator PS 3

Précis see „Testing Power Sources and Amplifiers“

Superhet Receiver ÜEL 2

Précis see „Instruments for Voltage and Level Measurement, Field Strength Meters, and Receivers“.

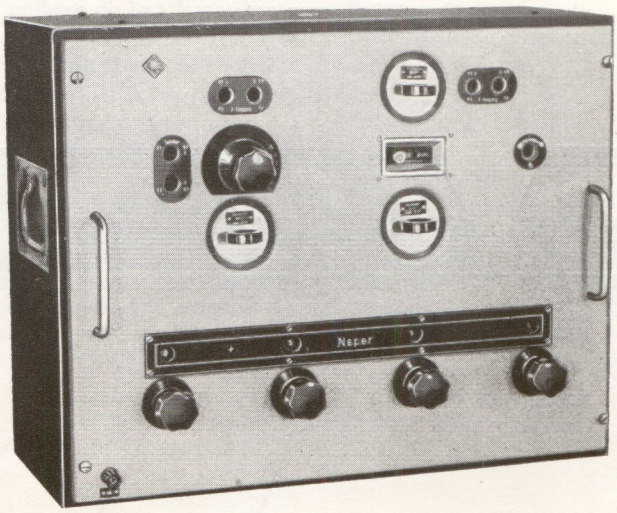


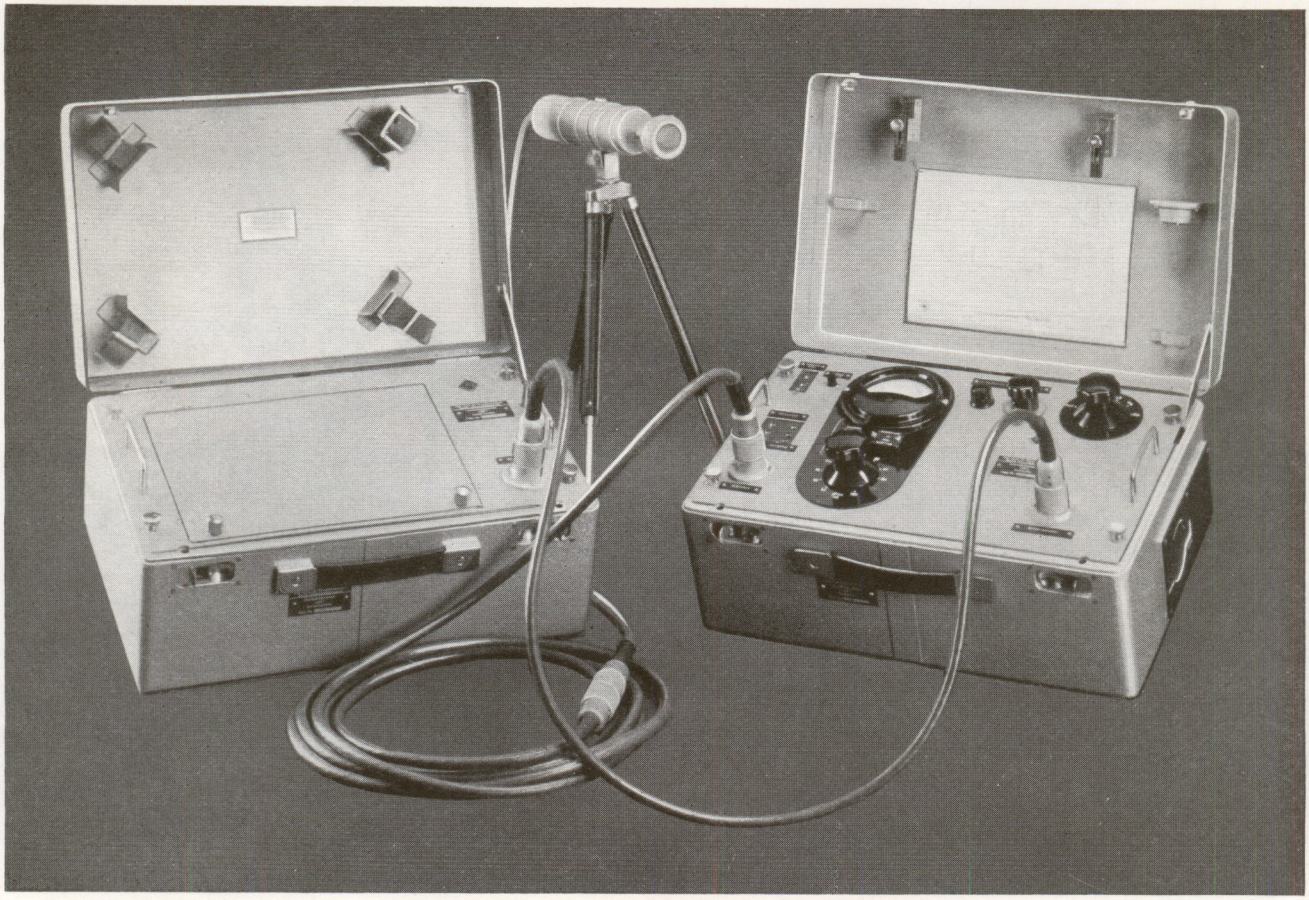
Attenuation Test Panel DMF 1

This unit is primarily involved in attenuation measurements to be accomplished in the crosstalk test assembly on the 10 to 1,200 kilocycle range. It enables the connection of symmetric and asymmetric test models having characteristic impedances of 150 and 600 ohms. By proper choice of screen cans and adjustment of the operating switches provision is made to determine near-end crosstalk and far-end crosstalk attenuation as well as the overall loss of transmission lines and cables. Attenuation measurements for a variety of fourpole networks having the characteristic impedances mentioned can also be carried out with this unit.

Characteristics at frequencies	10 — 300 kc	300 kc — 1.2 mc
(for symmetric test models of 150 and 600 ohms)		
near-end, far-end crosstalk, fourpole attenuation measurements	0–17 nepers ± 1 nep.	0–17 nep. ± 0.15 nep.
overall loss measurements	0–15 nepers ± 1 nep.	0–15 nep. ± 0.15 nep.
(for asymmetric test models of 150 and 600 ohms)		
near-end, far-end crosstalk, fourpole attenuation measurements	0–13 nepers ± 0.1 nep.	0–13 nep. ± 0.15 nep. 0–15 nep. ± 0.2 nep.
overall loss measurements	0–13 nepers ± 0.1 nep.	0–14 nep. ± 0.1 nep.

Measurement provided in stages of 0.01 neper, inherent attenuation ≥ 19 nepers, symmetrical attenuation for test model input and output ≥ 5 nepers, maximum input voltage + 3.1 nepers (approx. 17 volts), input resistance of the indicator ≥ 10 kohms, ≤ 25 mmf.





SOUND MEASURING EQUIPMENT

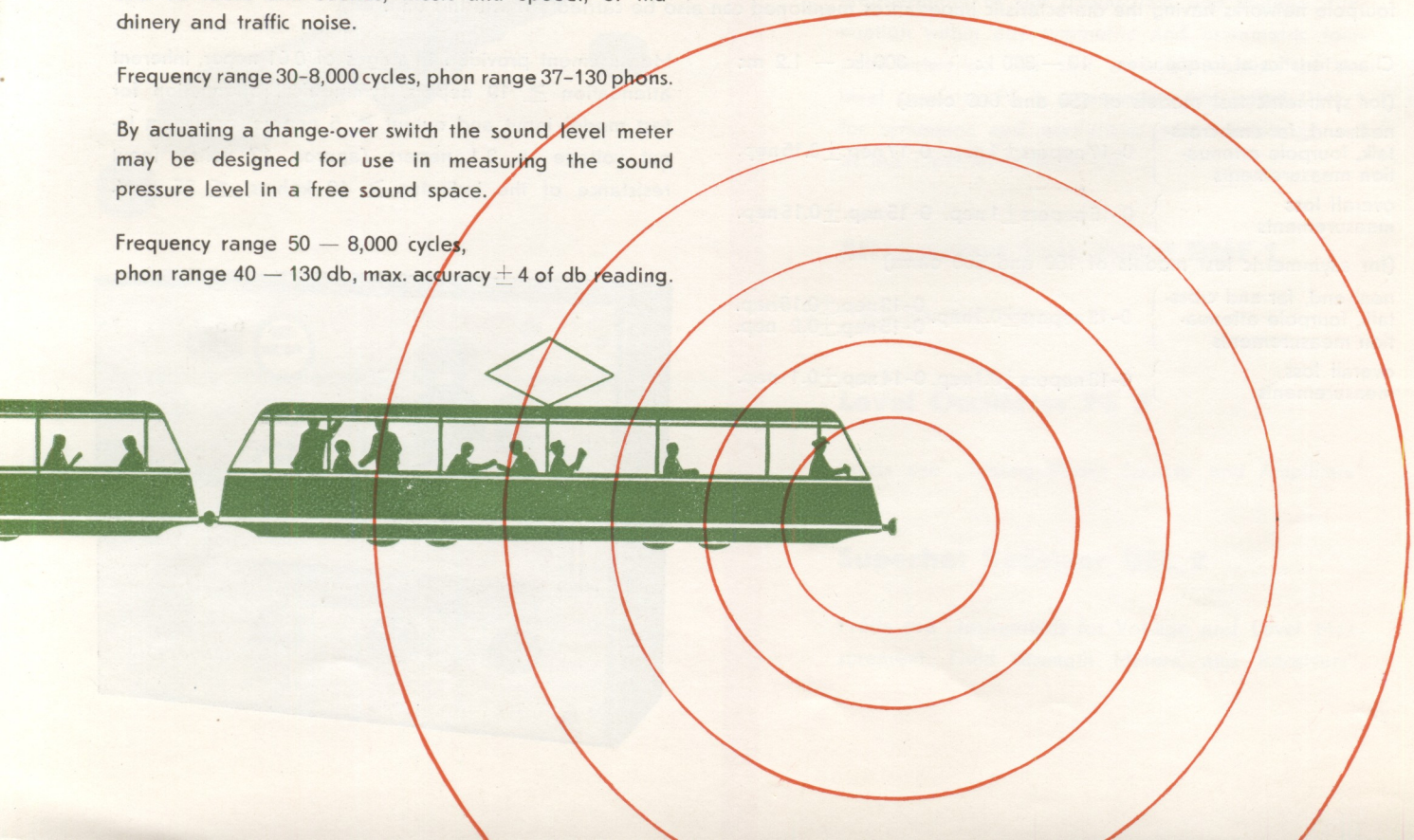
Sound Level Meter LSM 1

The sound level meter allows for the objective measurement of the loudness level occurring in sound waves, such as tones and sounds, music and speech, or machinery and traffic noise.

Frequency range 30–8,000 cycles, phon range 37–130 phons.

By actuating a change-over switch the sound level meter may be designed for use in measuring the sound pressure level in a free sound space.

Frequency range 50 — 8,000 cycles,
phon range 40 — 130 db, max. accuracy ± 4 of db reading.



INSTRUMENTATION FOR THE SERVICE INDUSTRY

TV Service Set FSK 1

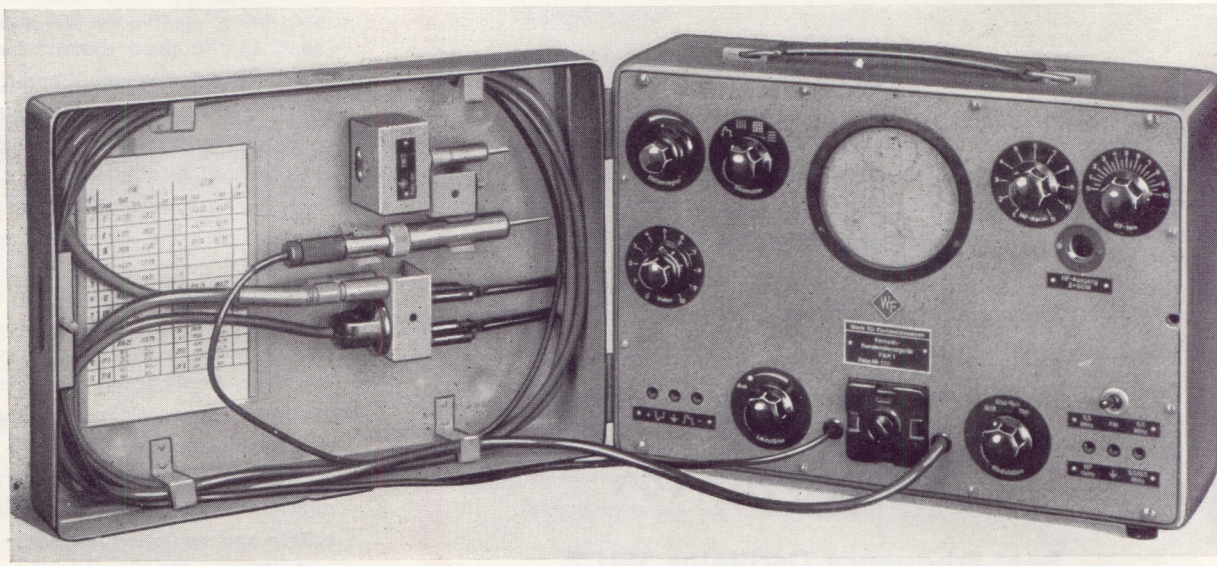
The tv service set FSK 1 provides signals which are similar to those supplied from a tv transmitter to tv receivers. Thus, in the majority of cases, the only use of this set will be completely satisfactory to check tv receivers.

Separate vertical and horizontal bars as well as a cross bar pattern featuring the positive and negative video signal are obtained from a pattern-signal generator. The r.f. generator undergoing video and audio signal modulation permits to check the tv bands I and III. Beyond that, through the use of i.f. channels provided in the tv service set the i.f. amplifiers of the receivers can also be subjected to checks.

The signal follower contained in the set is for the step-by-step scanning of the entire receiver the loudspeaker of the set operating as a checking device.

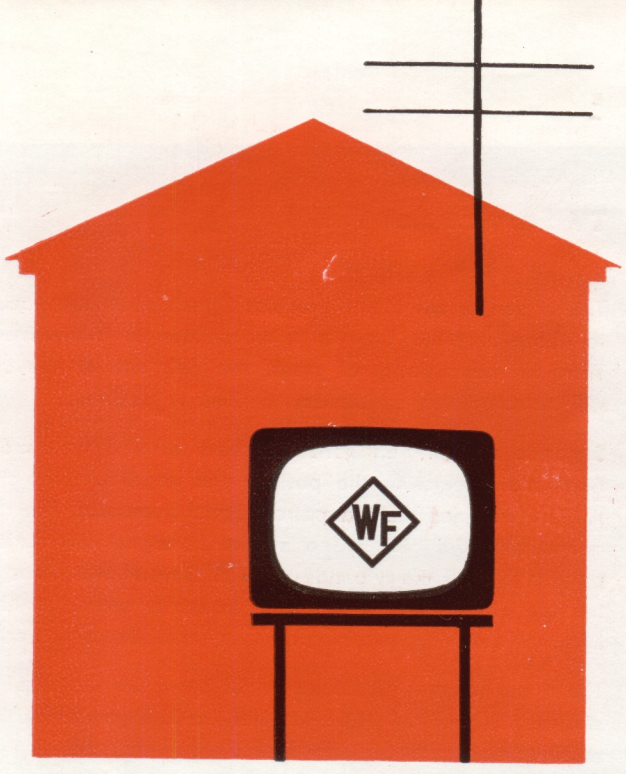
R.f. transmitter: channels I — IX in accordance with O. I. R. standards; channels 1, 2 and 4 — 11 in accordance with C. C. I. R. standards.

I.f. transmitter: two 19 — 38 mc bands (picture carrier frequency), output voltage 50 mvolts at 60 ohms, asymmetric.



F. m. transmitter: commutable to 5.5 and 6.5 mc, f. m. modulated with 1 kc, frequency deviation $\triangle f = \pm 50$ kc, output voltage 100 mvolts. A.f. generator: 1 kc, 2 $volts_{rms}$.

Video output: blanking sync pulse without interlacing, horizontal, vertical, and cross bars, variable, $U_{pk\ to\ pk}$ (both positive and negative) = 0 — 3 volts at output resistance 150 ohms, number of bars 3 to 12, slope 0.4×10^{-3} sec, line frequency 15,625 cycles, 625 lines at 50 cycles. Signal follower μ = 2,000-fold at 1 kilocycle, 1 watt speaker, a.f. and r.f. probe.



LATEST INSTRUMENTS

TV Service Set FSK 2

Designed for tv and v. h. f. receivers and embodying a multipurpose testing and measuring device this service set allows repairs just on site of the receivers.

Alongside with the frequencies between 5.2 and 6.8 mc 10.2 and 11.2 mc, 18 and 45 mc, 84 and 102 mc (band II) the fixed channel frequencies for channel 2 — 11 (in the bands I and III) are also supplied from the r. f. generator. This provides the possibility of producing the audio and video intermediate frequencies and establishing the v. h. f. broadcast range. The r. f. generator can be tone-modulated. By means of a pattern-signal generator the r. f. generator may be suitably modulated to exhibit either a cross-hatch pattern or neutral wedges.

Output voltage approx. 50 μvolts to 50 mvolts at 75 ohms, continuously variable. From the pattern generator a mixture of picture, blanking and sync signals continuously variable from 0.05 to about 1 $volt_{pk\ to\ pk}$ is supplied and used to take a positive and negative direction respectively. The sweep-signal generator built-in and operating on the 5 — 60 mc, 50 — 105 mc, and 175 — 230 mc ranges exhibits a controllable frequency deviation from $\pm$ 0.3 to $\pm$ 8 mc. Output voltage 50 μvolts — 100 mvolts from resistance of 75 ohms, continuously adjustable. This generator features the recording of any selectivity curves to be plotted for tv and v. h. f. receivers. Choice of picture or audio carrier marking is provided. Moreover, an operational test of the antenna array for adaptation is made possible by the sweep-signal generator. For the purpose of measuring the curves displayed the r. f. generator is used to adjust frequency markings shaped as needle-like pulses. The service set houses an oscilloscope that allows readings of any swept curves. Its continuously variable bias extending from — 1 to — 5 volts is usable for balancing keyed control tv receivers.

Universal Tube Volt Meter URV 1

Précis see „Instruments for Voltage and Level Measurement, Field Strength Meters, and Receivers.

Signal Generators PG 1, PG 2

Beat Frequency Oscillator SSU 2

Square Wave Testing Generators RWG 2, RWG 4

Power Amplifier LV 1

Précis see „Testing Power Sources and Amplifiers".

Inductance/Capacitance Meter LCM 1

Précis see „Impedance Meters"

INSTRUMENTS AND WAVEGUIDE COMPONENTS FOR THE 10 KMC AND 4 KMC RANGE

Instruments and Waveguide Components for the 10 KMC Range

Unless otherwise stated waveguides of type R 100 (22.86 × 10.16) are designed for use with contact flanges. As a result, nearly all components operate on the 8.2 to 12.4 kmc band of the waveguide. These frequencies, however, may give rise to partially deviating characteristics. The technical data specified for all instruments in the respective wave range is warranted.

Waveguide Measuring Section HML/X 4

For measuring adaptation and resistance in accordance with amount and phase, and for measuring wave lengths.

Frequency range 8.2 — 12,4 kmc

Detector Mount DK/X 5

Tunable waveguide for the indication of high-frequency energy by means of a detector.

Frequency range 9.1 — 9.7 kmc

Detector Mount DK/X 6

Allowing readings of high-frequency energy by means of a detector. No tuning required.

Frequency range 9.1 — 9.7 kmc

Klystron Mount KG/X 5

The klystron mount is used to couple variably the high-frequency energy into a waveguide thus providing high-frequency energy necessary for measurements.

Frequency range
of the waveguide 8.2 — 12.4 kmc
of the klystron 8.7 — 9.7 kmc

Klystron Mount KG/X 6

The klystron mount is used to couple high-frequency energy of a klystron into a waveguide. No tuning required.

Frequency range 9.1 — 9.7 kmc

Push-Pull Mixer Equipped with Preamplifier MK/X 5

Sensitive receiving device that is used in conjunction with an i.f. broadband amplifier to indicate minute high-frequency energies, to measure attenuation and related objects.

Frequency range 9.1 — 9.7 kmc

Mixer MK/X 6

Simplified sensitive receiving device. Oscillations fed through directional coupler. I.f. broadband amplifier required for measurements.

Frequence range 9.1 — 9.7 kmc

Wave Meter WM/X 3

Transmission frequency meter used for accurate determination of frequency or wave length, and for relative level control.

Frequency range 8.2 — 12.4 kmc

Echo Box EBX/X 2

Cavity resonator for most accurate measurements, frequency stabilizer for oscillators, artificial target for radar.

Frequency range 9.03 — 9.71 kmc,

waveguide connection R 100
(22.86 × 10.16) with choked flanges (⊣)

Power Meter LM/X 1

For measuring non-modulated high-frequency power according to the absorption principle. Waveguide connection R 100 (22.86 × 10.16) or F 100 (22.86 × 5.00).

Frequency range 9.1 — 9.7 kmc

Piston Attenuator VA/X 2

Used for the adjustment of any attenuation in the waveguide section.

Attenuation approx. 0 — 25 db

frequency range 9.1 — 9.7 kmc

Piston Attenuator VPA/X 3

Used for the adjustment of any attenuation in the waveguide section.

Attenuation approx. 0 — 65 db

frequency range 9.1 — 9.7 kmc

Pads

FA/X 6 (5 db) **FA/X 8** (20 db)
FA/X 7 (10 db) **FA/X 9** (30 db)

Required to introduce constant attenuation into a waveguide section.

Frequency range 9.1 — 9.7 kmc

Terminal Resistor AW/X 2

For matched termination of the waveguide.

Frequency range 9.1 — 9.7 kmc

Line Bends
LBH/X 2 LBE/X 2 LWH/X 2 LWE/X 2

Required to turn the line direction through 90 degrees.

Frequency range 8.2 — 12.4 kmc

Polarizing Rotary Joint PD/X 2

Used to match two waveguides provided by a simultaneous turning of the cross-sectional polarizing plane through 90 degrees.

Frequency range 8.2 — 12.4 kmc

T-Junctions TVH/X 2 TVE/X 2

Used to couple components or instruments to a waveguide section.

Frequency range 8.2 — 12.4 kmc

Adapter Waveguide to Coax AHK/X 2

For transition from the waveguide R 100 to a coaxial transmission line having 3/10 in diam. (Z = 70 ohms) and vice versa.

Frequency range 9.1 — 9.7 kmc

Choked and Contact Flange Intersections ZDK/X 3 (+); ZDK/X 4 (—)

Designed to join waveguides having contact flanges with waveguides having choked flanges.

Frequency range 9.1 — 9.7 kmc

waveguide connection R 100 (22.86 × 10.16)

ZDK/X 3 having choked flanges (—)
ZDK/X 4 having choked flanges (+)

Power Supply for Klystron Mounts NG/A 1 — 2

Resonator, repeller and heater voltages of adequate high stability are indispensable for operation of klystrons type 723 A/B, 2 K 25, 2 K 56, and analogous types. Supply from the power unit.

Waveguide Switches HU/X 4 HU/X 5

Designed to switch over the channel or the waveguide component connected to one of the two outputs coordinated. Sea-proof type HU/X 5.

Frequency range 9.1 — 9.7 kmc

waveguide connection R 100 (22.86 × 10.16) equipped with contact or choked flange.

Calibrated Adjustable Shorts RTR/X 5 RTR/X 6 RTR/X 7

Adaptable to the adjustment of any positive or negative reactances.

Frequency range 8.2 — 12.4 kmc or 9.1 — 9.7 kmc

Matched Transmission Line AL/X 2

Component designed to match load resistors to a waveguide.

Frequency range 8.2 — 12.4 kmc

Douoble T-Junction (Hybrid T) MT/X 3

Enabling the symmetrical coupling of two differen components or instruments, for bridge measurements in particular.

Frequency range 9.1 — 9.7 kmc

Directional Coupler RKP/X 2

Used for coarse control of the state of adaptation of a waveguide and as a simple coupling device having a low coupling coefficient.

Frequency range 9.1 — 9.7 kmc

Waveguide Joining Clutch VKL/X 1

Replacing circumstantial screwed joints and used for speedy and correct connection of two waveguides R 100 equipped with contact flange.

Assembly Frame for Waveguide Components AR/X 2

Holding device designed for single components or a whole line section if used with stands movable along the frame.

Usable for waveguide R 100 (22.86 × 10.16).

Single Stand for Waveguide Components EST/X 3

Use for the support of waveguide sections without assembly frame, such as assemblies fitted to the waveguide measuring section.

Usable for waveguide R 100 (22.86 × 10.16)

Instruments and Waveguide Components for 4 KMC Radio Relay Links

Unless otherwise stated waveguides of type R 40 (58.17 × 29.09) are designed for use with contact flanges. As a result, nearly all components operate on the 3.2 to 4.9 kmc band of the waveguide. The technical data specified for all instruments in the respective wave range is warranted.

Waveguide Measuring Section HML/V 1

For measuring adaptation and resistance in accordance with amount and phase, and for measuring wave lengths.

Frequency range 3.2 — 4.9 kmc

Detector Mount DK/V 1

Tunable waveguide for the indication of high-frequency energy by means of a detector.

Frequency range 3.5 — 4.2 kmc

Klystron Mount KG/V 1

The klystron mount is used to couple variably the high-frequency energy into a waveguide thus providing high-frequency energy necessary for measurements.

Frequency range 3.2 — 4.9 kmc

Power Supply for Klystron Mounts NG/A 1—2

Resonator, repeller and heater voltages of adequate high stability are indispensable for operation of klystrons type 2 K 25, 2 K 56, and analogous types. Supply from the power unit.

Test Receiver ME/V 1

Sensitive receiver for signals of the 3.4 — 4.9 kmc frequency range. Comprising i.f. calibrated attenuator, i.f. amplifier, and indicating panel.

Sensitivity in the band center $\leq 100\ kT_o$
degree of adaptation of receiver input $m \geq 0.8$
attenuation range of the attenuator 0 — 70 db
characteristic impedance of the attenuator 150/75 ohms
intermediate frequency $f_i = 35$ mc

Echo Box EBX/V 1

Cavity resonator for most accurate measurements, frequency stabilizer for oscillators.

Frequency range 3.86 — 4.14 kmc

Wave Meter WM/V 1

Transmission frequency meter used for accurate determination of frequency or wave length, and for relative level control.

Frequency range 3.2 — 4.9 kmc

Waveguide Switch HU/V 1

Designed to switch over the channel or the waveguide component connected to one of the two outputs coordinated.

Frequency range 3.5 — 4.2 kmc

Transmission Indicator DI/V 1

Used for the detection of high-frequency to be present in the line section. Ensuring lowest possible error of adaptation.

Frequency range 3.5 — 4.2 kmc

Power Meter LM/V 1

For measuring non-modulated high frequency power according to the absorption principle.

Frequency range 3.5 — 4.2 kmc,

waveguide connection R 40 (58.17 × 29.08) or F 40 (58.17 × 7.00) equipped with a contact flange

Calibrated Adjustable Short RTR/V 1

Adaptable to the adjustment of any positive or negative reactances.

Frequency range 3.2 — 4.9 kmc

Matched Transmission Line AL/V 1

Component designed to match load resistors to a waveguide R 40,

Frequency range 3.5 — 4.2 kmc

Piston Attenuator DGV/V 1

Used for the adjustment of any attenuations in a waveguide section.

Attenuation approx. 0 — 35 db

frequency range 3.5 — 4.2 kmc

Pads

DGF/V 1	5 db
DGF/V 2	10 db
DGF/V 3	20 db
DGF/V 4	30 db

Required to introduce constant attenuation into a waveguide section.

Frequency range 3.5 — 4.2 kmc

Terminal Resistor AW/V 1

For matched termination of a waveguide R 40.

Frequency range 3.5 — 4.2 kmc

Double T-Junction (Hybrid T) MT/V 1

Enabling the symmetrical coupling of two different components or instruments, for bridge measurements in particular.

Frequency range 3.5 — 4.2 kmc

Adapter Waveguide to Coax

Z = 70 ohms	**Z = 60 ohms**
AHK/V 1	**AHK/V 2**

For transition from the waveguide R 40 to a coaxial transmission line 5/16 in diam. or 6/16 in diam. and vice versa.

Frequency range 3.5 — 4.2 kmc

Line Bends LBH/V 1 LBE/V 1

Required to turn the line direction through 90 degrees.

Frequency range 3.5 — 4.9 kmc

Polarizing Rotary Joint PD/V 1

Used to join two waveguides provided by a simultaneous turning of the cross-sectional polarizing plane through 90 degrees.

Frequency range 3.2 — 4.9 kmc

T-Junctions TVH/V 1 TVE/V 1

Used to couple components or instruments to a waveguide section.

Frequency range 3.5 — 4.2 kmc

Single Stand EST/A 1

Holding device for line sections.

Waveguide Joining Clutch VKL/V 1

Replacing circumstantial screwed joints and used for speedy and correct connection of two waveguides equipped with contact flange.

Cathode-Ray Oscilloscope KOG 1

The cathode-ray oscilloscope is a high power oscilloscope having a maximum writing speed of 50,000 km/sec. Due to adjustable non-recurrent time-base deflection in terms of 8×10^{-9} to 1×10^{-6} sec for a screen length of 1 cm high-speed electrical processes can be studied.

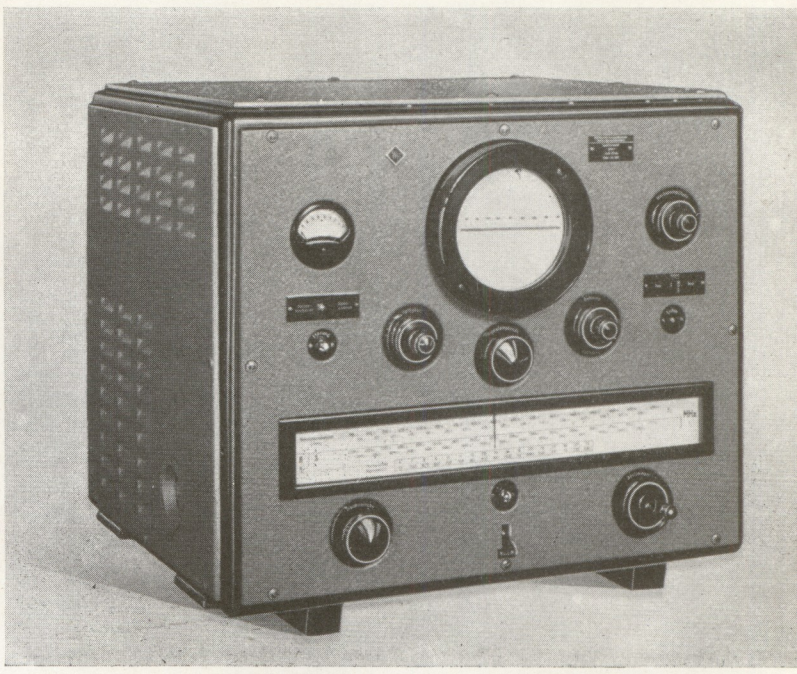
X-plate peak voltage about 2 kvolts, control voltage of the trigger-pulse unit $\geq$ 100 volts, release retardation about 6×10^{-8} sec, back recovery interval between two releases about 1 sec.

X-plate sensitivity approx. 0.03 mm/volt, Y-plate sensitivity approx. 0.03 mm/volt.

Spectrometer SPM 1

The spectrometer is required in the absolute measurement of frequencies, in the investigation of frequency stability and frequency spectrum of transmitters operating on the wave range $\lambda = 3 - 12$ cm (2.5 — 10 kmc). Accuracy is within $< 10^{-4}$ of reading. The transmitter subjected to test may be either in continuous wave or in keying operation. Measurement of pulse spectra is not provided. Along with the crystal-controlled frequency marking the frequency spectrum is displayed on the c.r.t. screen. The frequency bandwidth of a spectrum to be studied can be simultaneously visualized (max. 15 — 92 mc, min. 3 — 17.5 mc).

Input resistance Z = 70 ohms.



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DEUTSCHER INNEN- UND AUSSENHANDEL

Elektrotechnik

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TELEGRAMS: DIAELEKTRO · TELEX 011415

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Issue November 1959

IV/5/6 Böhm & Bullick KG, Dessau. Nr. Ag 30/867/59 21859 5000